Integration of Dust Prediction Systems and Vegetation Phenology to Track Pollen for Asthma Alerts in Public Health

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Pollen can be transported great distances. Van de Water et. al., 2003 reported Juniperus pollen, a significant aeroallergen was transported 200-600 km. Hence local observations of plant phenology may not be consistent with the timing and source of pollen collected by pollen sampling instruments. The DREAM (Dust REgional Atmospheric Model, Yin 2007) is a verified model for atmospheric dust transport modeling using MODIS data products to identify source regions and quantities of dust (Yin 2007). The use of satellite data products for studying phenology is well documented (White and Nemani 2006). We are modifying the DREAM model to incorporate pollen transport. The linkages already exist with DREAM through PHAiRS (Public Health Applications in remote Sensing) to the public health community. This linkage has the potential to fill this data gap so that health effects of pollen can better be tracked for linkage with health outcome data including asthma, respiratory effects, myocardial infarction, and lost work days. DREAM is based on the SKIRON/Eta modeling system and the Eta/NCEP regional atmospheric model. The dust modules of the entire system incorporate the state of the art parameterizations of all the major phases of the atmospheric dust life such as production, diffusion, advection, and removal. These modules also include effects of the particle size distribution on aerosol dispersion. The dust production mechanism is based on the viscous/turbulent mixing, shear-free convection diffusion, and soil moisture. In addition to these sophisticated mechanisms, very high resolution databases, including elevation, soil properties, and vegetation cover are utilized. The DREAM model was modified to use pollen sources instead of dust (PREAM). Pollen release will be estimated based on satellite-derived phenology of Juniperus spp. communities. The MODIS surface reflectance product (MOD09) will provide information on the start of the plant growing season, growth stage, peak greenness, dry-down and pollen release. Ground based observational records of pollen release timing and quantities will be used as verification. Techniques developed using MOD09 surface reflectance products will be directly applicable to the next generation sensors such as VIIRS. The resulting deterministic model for predicting and simulating pollen emission and downwind concentration to study details of phenology and meteorology and their dependencies. This information will be used to support the Centers for Disease Control and Prevention (CDC)'s National Environmental Public Health Tracking Program (EPHT) and the State of New Mexico environmental public health decision support for asthma and allergies alerts.